

## PATENT COOPERATION TREATY

PCT

## NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Commissioner  
 US Department of Commerce  
 United States Patent and Trademark  
 Office, PCT  
 2011 South Clark Place Room  
 CP2/5C24  
 Arlington, VA 22202  
 ETATS-UNIS D'AMERIQUE  
 in its capacity as elected Office

<b>Date of mailing (day/month/year)</b> 26 February 2001 (26.02.01)	
<b>International application No.</b> PCT/DK00/00319	<b>Applicant's or agent's file reference</b> P199900712WO
<b>International filing date (day/month/year)</b> 14 June 2000 (14.06.00)	<b>Priority date (day/month/year)</b> 14 June 1999 (14.06.99)
<b>Applicant</b> PETERSEN, Jes, H. et al	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:27 December 2000 (27.12.00)☐ in a notice effecting later election filed with the International Bureau on:2. The election ☒ was☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

<b>The International Bureau of WIPO</b> 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	<b>Authorized officer</b>  R. E. Stoffel Telephone No.: (41-22) 338.83.38
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## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

14

Applicant's or agent's file reference P199900712WO	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/DK00/00319	International filing date (day/month/year) 14/06/2000	Priority date (day/month/year) 14/06/1999
International Patent Classification (IPC) or national classification and IPC F28F3/10		
Applicant APV HEAT EXCHANGER A/S et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.



2. This REPORT consists of a total of 5 sheets, including this cover sheet.

- ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 8 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☒ Certain defects in the international application
- VIII ☒ Certain observations on the international application

Date of submission of the demand  27/12/2000	Date of completion of this report  28.06.2001
Name and mailing address of the international preliminary examining authority:   European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer  Martínez Rico, C  Telephone No. +49 89 2399 2750 

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/DK00/00319

## I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

### Description, pages:

6-13	as originally filed	
1-5	with telefax of	18/06/2001

### Claims, No.:

1-10	with telefax of	18/06/2001
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### Drawings, sheets:

1/3-3/3	as originally filed
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2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/DK00/00319

- ☐ the description, pages:  
☐ the claims, Nos.:  
☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

**1. Statement**

Novelty (N)	Yes:	Claims	1-10
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-10
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-10
	No:	Claims	

2. Citations and explanations  
**see separate sheet**

**VII. Certain defects in the international application**

The following defects in the form or contents of the international application have been noted:  
**see separate sheet**

**VIII. Certain observations on the international application**

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:  
**see separate sheet**

## **Section V**

### **1. Claim 1**

The subject matter of claim 1 fulfils the requirements of novelty, inventive step and industrial applicability according to Article 33(1)-(4) PCT. In the following an analysis of the state of the art and the inventive step is provided.

Prior art document SU-A-1 430 716 shows a plate for a heat exchanger comprising a groove for an associated gasket like the one in the application. Extensions for coupling the gasket are also provided. Nevertheless, these ones are having bridges parallel to the groove and comprising apertures to accommodate the lugs of the gasket, instead of tongues perpendicular to the longitudinal direction of the groove.

Document EP-A-0 762 071, which has been cited in the application and is from the same family as US-A-5 988 268, relates to a heat exchanger plate comprising a groove for an associated gasket. The embodiments of figures 13 to 15 concern in particular to a groove comprising two ridge, tongue-like portions at one side, each of them provided with an aperture in order to introduce a gasket having a T-shape. Even if the plate described in this document is provided with an expanded portion situated in the same plane as the groove and with tongues like the ones mentioned in claim 1 of the application, the openings are not located at each side of the tongue-like portion, so that the construction of the plate and its associated gasket are completely different from the subject matter of claim 1.

Document US-A-4 905 758, which has also been cited in the application, discloses a heat exchanger plate having a groove for a gasket and an expanded portion to couple the gasket to the plate. Due to the fact that the holding force between the gasket and the plate is determined by the engagement between the expanded portion and the upper edge of the openings (see the application as filed, description page 4, lines 12-15), a narrow tolerance between the upper edges is necessary. Nevertheless, this tolerance is with the construction of US-A-4 905 758 difficult to achieve due to the contractions that the plate material suffers. In order to solve this technical problem, the subject matter of claim 1 includes a tongue-like portion, which is not influence by the contraction of the surrounding material. In such a way, being

the openings located at each side of the tongue-like portions, the distance between the edges which the gasket engages is manufactured with a narrow tolerance.

2. Claims 2 to 10

Dependent claims 2 to 10 are concerned to particular embodiments of claim 1 and hence also meet the requirements of Article 33(1)-(4) PCT.

**Section VII**

Dependent claims 4 to 10 refer indeed to the use of a heat exchanger plate according to claim 1 or to any of the preceding claims together with an associated gasket. Therefore these claims should have been formulated in a more clear way by referring to the "use of a heat exchanger plate according to claim ... with an associated gasket...", instead of to a "heat exchanger plate according to claim...".

**Section VIII**

The amendments filed introduce subject-matter which extends beyond the content of the application as filed, contrary to Article 34(2)(b) PCT. The amendment concerned is the indication of the position of the expanded portion, i.e. "the expanded portion being situated substantially in the same plane as the gasket groove" (see lines 10 and 11). Although it is clearly disclosed in figures 2 and 5 that the expanded portion is situated in the same plane as the groove, the word substantially should be omitted in the claim, due to the fact that it would imply any other different plane.

REPLACED BY  
ART 34 AMDT

A heat exchanger plate and such a plate with a gasket

5 The invention relates to a plate for a plate-type heat exchanger according to the preamble of claim 1, and such plate with associated gasket according to the preamble of claim 4.

10 Plate-type heat exchangers are constructed of a number of plates separated by gaskets. In general, each plate has a rectangular configuration and at each corner it is provided with inlet and outlet openings for two heat exchanger media. The plate is ridged into a corrugated pattern and provided with a gasket that will, when the plate-type heat exchanger is assembled, abut on the next  
15 plate in the stack. The gasket defines a flow area that is in contact with two of the corner openings and therefore allows flow of a first heat exchanger medium to this side of the plate. The two remaining corner openings are cut off by the gasket. The subsequent heat exchanger  
20 plate in the stack has been rotated 180°, and thus its gasket defines a flow area that is in contact with the two other corner openings on the opposite side of the first plate and permits flow of another heat exchanger medium on this side of the plate. By rotating every other  
25 heat exchanger plate 180° a plate-type heat exchanger is constructed wherein every other space is flushed by the first heat exchanger medium whereas the remaining spaces are flushed by the other heat exchanger medium.

30 Generally, every heat exchanger plate is provided with a gasket groove wherein a gasket that is preferably made of rubber can be arranged. In order to facilitate assembly of the plate-type heat exchanger, the gasket is secured in the gasket groove and this can be accomplished in a

variety of ways. Conventionally the gasket is glued into the gasket groove, but in view of the fact that this causes a problem in connection with a subsequent disassembly of the plate-type heat exchanger, alternative mechanical attachment methods have been developed.

Such mechanical attachment methods can be divided into two groups. In the first group the attachment is accomplished in that the gasket is provided with a protruding portion that can engage with an opening provided in connection with the gasket groove. The opening can be a punched opening (eg as shown in US-A-4 377 204) or it may be formed by cutting and ridging of plate material whereby an opening is formed without removal of material (eg as shown in US-A-4 905 758). In the other group the gasket and the gasket groove are configured such that the gasket extends beyond the edge of the heat exchanger plate and is secured there by means of flaps that seize around the edge (eg as shown in EP 0 762 071).

The present invention relates to the group of attachment methods wherein openings are provided by cutting and ridging of plate material as shown in US-A-4 905 758. This method presents a number of advantages compared to the other methods mentioned.

The method in which an opening is punched into the heat exchanger plate near the gasket groove is associated with the drawback that the punching of the opening - or in reality the many holes that are spaced apart along the gasket groove - presupposes either a separate series of operation following ridging of the plate, or it presupposes that the ridging tool is also provided with punching tools which significantly increases the cost of such



tool. Besides, the latter solution is undesirable since there will be a risk that punched-out parts remain in the ridging tool and is thereby detrimental to the subsequent ridging/punching process.

5

Cutting and ridging of material to form the opening can be accomplished in the same operation procedure as the ridging of the plate itself, and thus no separate operation procedure is required and, likewise, the demands to the large tolerances of the cutting tool are not high, and it can therefore relatively inexpensively be incorporated in the ridging tool.

10

In the methods where the gasket and the gasket groove are configured such that the gasket extends beyond the periphery of the heat exchanger plate and is secured there by means of flaps that engage around the edge, a complex configuration of the gasket is necessary which, on the one hand, increases the cost of manufacture of such gasket and, on the other, renders the mounting of the gasket cumbersome and time-consuming.

15

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A gasket for mounting in openings formed by cutting and ridging of material may have a simple configuration and is comparatively readily mounted in the gasket groove.

25

US-A-4 905 758 teaches a heat exchanger plate with a gasket groove provided, at intervals, with an expanded portion that is situated in the same plane as the gasket groove itself, and which is therefore pressed down relative to the surrounding gasket material. By the pressing-down the ends of the expanded portion have been cut open, whereby openings are formed there in a plane located sub-

30

stantially perpendicular to the longitudinal direction of the gasket groove.

5 The gasket is provided with protruding coupling elements that fit into the expanded portions of the gasket groove, their configuration being such that they are able to engage with the openings that are provided at each end of the expanded portions.

10 Securing of the gasket is accomplished in that the ends of the expanded coupling element of the gasket are pressed into the openings, which means that the holding force is determined by the engagement between the expanded portion of the gasket and primarily the upper edge  
15 of the openings.

It has been found that in the manufacture of heat exchanger plates with a configuration that corresponds to the one shown in US-A-4 905 758, it is difficult to observe the requisite tolerances on the distance between  
20 the two upper edges of the openings, the plate material contracting when the initially plane plate is pressed upwards to the desired profiled shape. The extent of the contraction depends in part on the ridging of the surrounding material, in part on the plate material and in  
25 part on the plate thickness. The distance between the two upper edges can thus vary from plate to plate and from coupling site to coupling site along the gasket groove, with an ensuing undesirable variation in the holding  
30 force between the expanded portion of the gasket groove and the coupling element of the gasket. Such irregular holding force may give rise to problems during assembly of a plate-type heat exchanger since a gasket may unin-

tentionally be displaced out of the gasket groove in case it is not sufficiently attached.

5 It is the object of the present invention to provide a heat exchanger plate of the above-mentioned type, wherein the distance between the edges with which the gasket engages can be manufactured within narrow tolerances so as to overcome the above-mentioned drawbacks.

10 This is obtained by configuring the plate mentioned above as featured in the characterising part of claim 1 and as featured in the characterising part of claim 4 with regard to the combination of a plate and a gasket.

15 Hereby a heat exchanger plate is obtained wherein the expanded portion features securing openings to each side of the ridged, tongue-like portion(s), and the distance between the openings formed can be kept within narrow tolerances, the ridged, tongue-like portion(s) not being influenced by the contraction pattern of the surrounding  
20 material as such during manufacture of the plate. Such configuration of the heat exchanger plate thus enables that all the mutually spaced expanded portions feature securing openings, whose mutual distance is kept within  
25 the same narrow tolerances independently of the ridging as such and of the plate material and thickness. Besides, this also means that the same ridging tool can be used in the manufacture of heat exchanger plates made of different materials and having different thicknesses. Since the  
30 coupling elements of the gasket that are configured for engaging with these tolerances can also be manufactured within narrow tolerances, it is possible to obtain a homogeneous holding force throughout the space between the plate and the gasket.

C l a i m s

1. A heat exchanger plate (1;21) for a plate-type heat exchanger, said plate (1;21) comprising a gasket groove (6;26) in the form of an indentation that extends, at least across that portion of the plate (1;21), close to the periphery of the plate and is, at intervals, provided with an expanded portion (7;27) for receiving a coupling element (10;30;40) on an associated gasket (3;33;43), wherein there is, in connection with each of the expanded portions (7;27) of the gasket groove (6;26), by cutting and ridging of the plate material provided at least two openings (8;28) substantially perpendicular to the longitudinal direction of the gasket groove, said openings (8;28) being configured for engaging with said coupling element (10;30;40), characterised in that in the expanded portion (7;27) and substantially perpendicular to the gasket groove (6;26) there is provided at least one ridged, tongue-like portion (9;29), wherein the openings (8;28) are located at each side of the tongue-like portion (9;29) between this and the expanded portion (7;27) of the gasket groove (6;26).

2. A heat exchanger plate according to claim 1, characterised in that one ridged, tongue-like portion (9) is provided centrally in the expanded portion (7).

3. A heat exchanger plate according to claim 1, characterised in that two ridged, tongue-like portions (29) are provided at a distance from each other in the expanded portion (27).

4. A heat exchanger plate (1;21) with a gasket (3;33,43) for a plate-type heat exchanger, said plate (1;21) com-

prising a gasket groove (6;26) in the form of an indentation that extends, at least across that portion of the plate (1;21), close to the periphery of the plate and is, at intervals, provided with an expanded portion (7;27) for receiving a coupling element (10;30;40) on the gasket, (3;33;43), wherein there is provided, in connection with each of the expanded portions (7;27) of the gasket groove (6;26) - by cutting and ridging of plate material - at least two openings (8;28) substantially perpendicular to the longitudinal direction of the gasket groove, and wherein the coupling element (10;30;40) of the gasket comprises protruding flaps (11;31;42) that are able to engage with the openings (8;28), characterised in that in the expanded portion (7;27) and substantially perpendicular to the gasket groove (6;26) there is provided at least one ridged, tongue-like portion (9;29), wherein said openings (8;28) are located at each side of the tongue-like portion (9;29) between this and the expanded portion (7;27) of the gasket groove (6;26); and that the coupling element (10;30;40) of the gasket is configured for being able to engage with said openings (8;28).

5. A heat exchanger plate with gasket according to claim 4, characterised in that one ridged, tongue-like portion (9) is provided centrally in the expanded portion (7); and that the coupling element (10) of the gasket comprises two protruding flaps (11) that are configured for engaging with the openings (8) provided at each side of the tongue-like portion (9).

6. A heat exchanger plate with gasket according to claim 4, characterised in that two ridged, tongue-like portions (29) are provided at a distance from each other in the expanded portion (27); and that the coupling element (30)

of the gasket comprises a protruding flap (31) configured for engaging with the two central and mutually facing openings 28 (28) provided at each their tongue-like portion (29).

5

7. A heat exchanger plate with gasket according to claim 4, characterised in that two ridged, tongue-like portions (29) are provided at a distance from each other in the expanded portion (27); and that the coupling element (40)  
10 of the gasket comprises two outwardly protruding flaps (42) that are configured for engaging with the two mutually most distant openings (28) provided at each their tongue-like portion (29).

15 8. A heat exchanger plate with gasket according to any one of claims 4-7, characterised in that the flaps (11;31,42) on the coupling elements (10;30;40) of the gasket extend partially into the openings (8;28).

20 9. A heat exchanger plate according to any one of claims 4-7, characterised in that the flaps (11;31;42) on the coupling elements (10;30;40) of the gasket press on the openings (8;28) without extending considerably into same.

25 10. A heat exchanger plate with gasket according to any one of claims 4-9, characterised in that the coupling element (10;30;40) of the gasket is provided with a superjacent pressure element (34).

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REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

International Application No. PCT/DK 00/00319

International Filing Date 14 JUNE 2000

Danish Patent and Trademark Office  
PCT-International Application  
Name of receiving Office and "PCT International Application"

Applicant's or agent's file reference (if desired) (12 characters maximum) P199900712WO

Box No. I TITLE OF INVENTION

Heat exchanger plate and such a plate with a gasket.

Box No. II APPLICANT

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

APV Heat Exchanger A/S  
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☐ This person is also inventor..

Telephone No.

Facsimile No.

Teleprinter No.

State (that is, country) of nationality:

DK Denmark

State (that is, country) of residence:

DK Denmark

This person is applicant for the purposes of:

☐ all designated States

☒ all designated States except the United States of America

☐ the United States of America only

☐ the States indicated in the Supplemental Box

Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

PETERSEN, Jes H.  
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Denmark

This person is:

☐ applicant only

☒ applicant and inventor

☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

DK Denmark

State (that is, country) of residence:

DK Denmark

This person is applicant for the purposes of:

☐ all designated States

☐ all designated States except the United States of America

☒ the United States of America only

☐ the States indicated in the Supplemental Box

☒ Further applicants and/or (further) inventors are indicated on a continuation sheet.

Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as:

☒ agent

☐ common representative

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

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☐ Address for correspondence: Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

## Continuation of Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

*If none of the following sub-boxes is used, this sheet should not be included in the request.*

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

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Læssøegade 24  
DK-6000 Kolding  
Denmark

This person is:

- ☐ applicant only  
☒ applicant and inventor  
☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

DK Denmark

State (that is, country) of residence:

DK Denmark

This person is applicant for the purposes of:

- ☐ all designated States ☐ all designated States except the United States of America ☒ the United States of America only ☐ the States indicated in the Supplemental Box

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

This person is:

- ☐ applicant only  
☐ applicant and inventor  
☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

State (that is, country) of residence:

This person is applicant for the purposes of:

- ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

This person is:

- ☐ applicant only  
☐ applicant and inventor  
☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

State (that is, country) of residence:

This person is applicant for the purposes of:

- ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

This person is:

- ☐ applicant only  
☐ applicant and inventor  
☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

State (that is, country) of residence:

This person is applicant for the purposes of:

- ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

☐ Further applicants and/or (further) inventors are indicated on another continuation sheet.



**Box No.V DESIGNATION STATES**

The following designations are hereby made under Rule 4.9(a) (mark the applicable check-boxes; at least one must be marked):

**Regional Patent**

- ☒ **AP ARIPO Patent:** GH Ghana, GM Gambia, KE Kenya, LS Lesotho, MW Malawi, SD Sudan, SL Sierra Leone, SZ Swaziland, TZ United Republic of Tanzania, UG Uganda, ZW Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT
- ☒ **EA Eurasian Patent:** AM Armenia, AZ Azerbaijan, BY Belarus, KG Kyrgyzstan, KZ Kazakhstan, MD Republic of Moldova, RU Russian Federation, TJ Tajikistan, TM Turkmenistan, and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT
- ☒ **EP European Patent:** AT Austria, BE Belgium, CH and LI Switzerland and Liechtenstein, CY Cyprus, DE Germany, DK Denmark, ES Spain, FI Finland, FR France, GB United Kingdom, GR Greece, IE Ireland, IT Italy, LU Luxembourg, MC Monaco, NL Netherlands, PT Portugal, SE Sweden, and any other State which is a Contracting State of the European Patent Convention and of the PCT
- ☒ **OA OAPI Patent:** BF Burkina Faso, BJ Benin, CF Central African Republic, CG Congo, CI Côte d'Ivoire, CM Cameroon, GA Gabon, GN Guinea, GW Guinea-Bissau, ML Mali, MR Mauritania, NE Niger, SN Senegal, TD Chad, TG Togo, and any other State which is a member State of OAPI and a Contracting State of the PCT (if other kind of protection or treatment desired, specify on dotted line)

**National Patent** (if other kind of protection or treatment desired, specify on dotted line):

- |   |   |
|---|---|
| <input checked="" type="checkbox"/> <b>AE</b> United Arab Emirates                  | <input checked="" type="checkbox"/> <b>LR</b> Liberia                                   |
| <input checked="" type="checkbox"/> <b>AL</b> Albania                               | <input checked="" type="checkbox"/> <b>LS</b> Lesotho                                   |
| <input checked="" type="checkbox"/> <b>AM</b> Armenia                               | <input checked="" type="checkbox"/> <b>LT</b> Lithuania                                 |
| <input checked="" type="checkbox"/> <b>AT</b> Austria and Utility Model             | <input checked="" type="checkbox"/> <b>LU</b> Luxembourg                                |
| <input checked="" type="checkbox"/> <b>AU</b> Australia                             | <input checked="" type="checkbox"/> <b>LV</b> Latvia                                    |
| <input checked="" type="checkbox"/> <b>AZ</b> Azerbaijan                            | <input checked="" type="checkbox"/> <b>MA</b> Morocco                                   |
| <input checked="" type="checkbox"/> <b>BA</b> Bosnia and Herzegovina                | <input checked="" type="checkbox"/> <b>MD</b> Republic of Moldova                       |
| <input checked="" type="checkbox"/> <b>BB</b> Barbados                              | <input checked="" type="checkbox"/> <b>MG</b> Madagascar                                |
| <input checked="" type="checkbox"/> <b>BG</b> Bulgaria                              | <input checked="" type="checkbox"/> <b>MK</b> The former Yugoslav Republic of Macedonia |
| <input checked="" type="checkbox"/> <b>BR</b> Brazil                                | <input checked="" type="checkbox"/> <b>MN</b> Mongolia                                  |
| <input checked="" type="checkbox"/> <b>BY</b> Belarus                               | <input checked="" type="checkbox"/> <b>MW</b> Malawi                                    |
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| <input checked="" type="checkbox"/> <b>CH and LI</b> Switzerland and Liechtenstein  | <input checked="" type="checkbox"/> <b>NO</b> Norway                                    |
| <input checked="" type="checkbox"/> <b>CN</b> China                                 | <input checked="" type="checkbox"/> <b>NZ</b> New Zealand                               |
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| <input checked="" type="checkbox"/> <b>CZ</b> Czech Republic and Utility Model      | <input checked="" type="checkbox"/> <b>RO</b> Romania                                   |
| <input checked="" type="checkbox"/> <b>DE</b> Germany and Utility Model             | <input checked="" type="checkbox"/> <b>RU</b> Russian Federation                        |
| <input checked="" type="checkbox"/> <b>DK</b> Denmark and Utility Model             | <input checked="" type="checkbox"/> <b>SD</b> Sudan                                     |
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| <input checked="" type="checkbox"/> <b>EE</b> Estonia and Utility Model             | <input checked="" type="checkbox"/> <b>SG</b> Singapore                                 |
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| <input checked="" type="checkbox"/> <b>HR</b> Croatia                               | <input checked="" type="checkbox"/> <b>TZ</b> United Republic of Tanzania               |
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| <input checked="" type="checkbox"/> <b>KG</b> Kyrgyzstan                            | <input checked="" type="checkbox"/> <b>ZW</b> Zimbabwe                                  |
| <input checked="" type="checkbox"/> <b>KP</b> Democratic People's Republic of Korea |   |
| <input checked="" type="checkbox"/> <b>KR</b> Republic of Korea                     |   |
| <input checked="" type="checkbox"/> <b>KZ</b> Kazakhstan                            |   |
| <input checked="" type="checkbox"/> <b>LC</b> Saint Lucia                           |   |
| <input checked="" type="checkbox"/> <b>LK</b> Sri Lanka                             |   |

Check-boxes reserved for designating States which have become party to the PCT after issuance of this sheet:

- ☒ **DZ** Algeria
- ☒ **AG** Antigua and Barbuda
- ☒ **MZ** Mozambique

**Precautionary Designation Statement:** In addition to the designations made above, the applicant also makes under Rule 4.9(b) all other designations which would be permitted under the PCT except any designation(s) indicated in the Supplemental Box as being excluded from the scope of this statement. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit. (Confirmation (including fees) must reach the receiving Office within the 15-month time limit.)

<b>Box No. VI PRIORITY CLAIM</b>		<input type="checkbox"/> Further priority claims are indicated in the Supplemental Box		
Filing date of earlier application (day/month/year)	Number of earlier application	Where earlier application is:		
		national application: country	regional application: regional Office	international application: receiving Office
item (1) 14 June 1999	PA 199900838	Denmark		
item (2)				
item (3)				

☐ The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) (only if the earlier application was filed with the Office which for the purposes of the present international application is the receiving Office) identified above as item(s):

\* Where the earlier application is an ARIPO application, it is mandatory to indicate in the Supplemental Box at least one country party to the Paris Convention for the Protection of Industrial Property for which that earlier application was filed (Rule 4.10(b)(ii)). See Supplemental Box.

### Box No. VII INTERNATIONAL SEARCHING AUTHORITY

**Choice of International Searching Authority (ISA)**  
(if two or more International Searching Authorities are competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used):

ISA/ SE

**Request to use results of earlier search; reference to that search (if an earlier search has been carried out by or requested from the International Searching Authority):**

Date (day/month/year)

02 Sep. 1999

Number

DK 99/00090

Country (or regional Office)

Denmark

### Box No. VIII CHECK LIST; LANGUAGE OF FILING

This international application contains the following number of sheets:

request : 4

description (excluding sequence listing part) : 11

claims : 3

abstract : 1

drawings : 3

sequence listing part of description : \_\_\_\_\_

Total number of sheets : 22

This international application is accompanied by the item(s) marked below:

1. ☒ fee calculation sheet
2. ☐ separate signed power of attorney
3. ☐ copy of general power of attorney; reference number, if any:
4. ☐ statement explaining lack of signature
5. ☐ priority document(s) identified in Box No. VI as item(s):
6. ☐ translation of international application into (language):
7. ☐ separate indications concerning deposited microorganism or other biological material
8. ☐ nucleotide and/or amino acid sequence listing in computer readable form
9. ☒ other (specify): Copy of DK 99/00090

Figure of the drawings which should accompany the abstract: 2+3

Language of filing of the international application: Danish

### Box No. IX SIGNATURE OF APPLICANT OR AGENT

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).

Finn Scholten  
R&D Manager  
APV Heat Exchanger A/S

Jes H. Petersen

[Signature]

Benny Jensen  
Tool designer  
Benny Jensen

For receiving Office use only		2. Drawings:  <input type="checkbox"/> received:  <input type="checkbox"/> not received:
1. Date of actual receipt of the purported international application:	RO/DK 14 JUN 2000 (14.06.2000)	
3. Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application:		
4. Date of timely receipt of the required corrections under PCT Article 11(2):		
5. International Searching Authority (if two or more are competent): ISA/ SE	6. <input type="checkbox"/> Transmittal of search copy delayed until search fee is paid.	

For International Bureau use only	
Date of receipt of the record copy by the International Bureau:	30 JUNE 2000 (30.06.00)

1/3

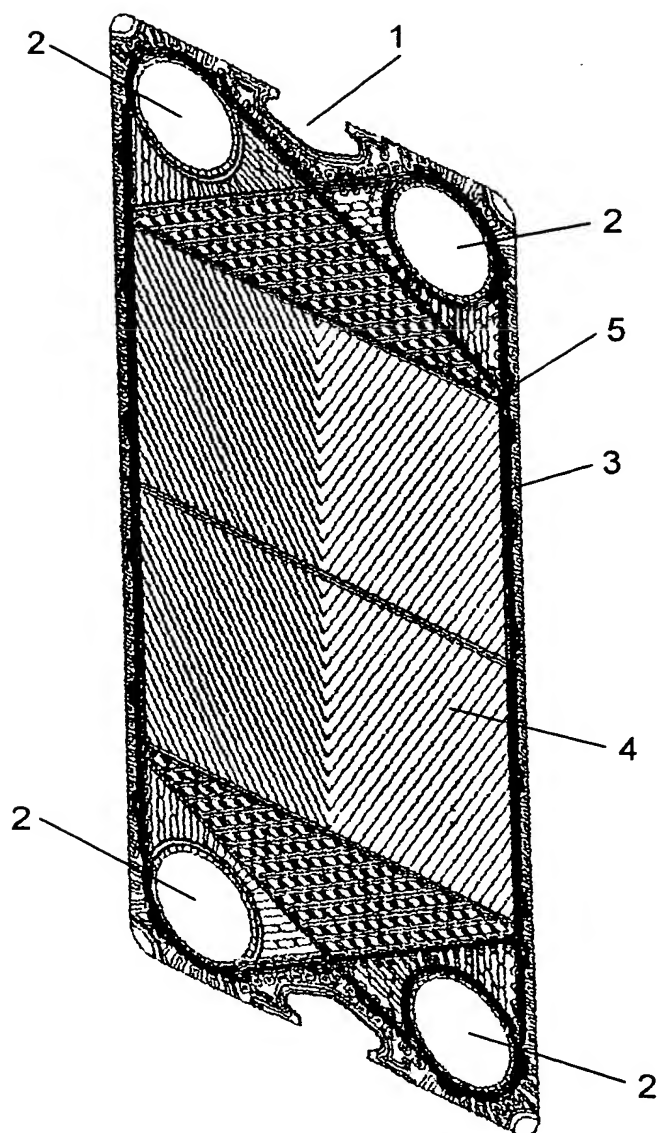


Fig. 1

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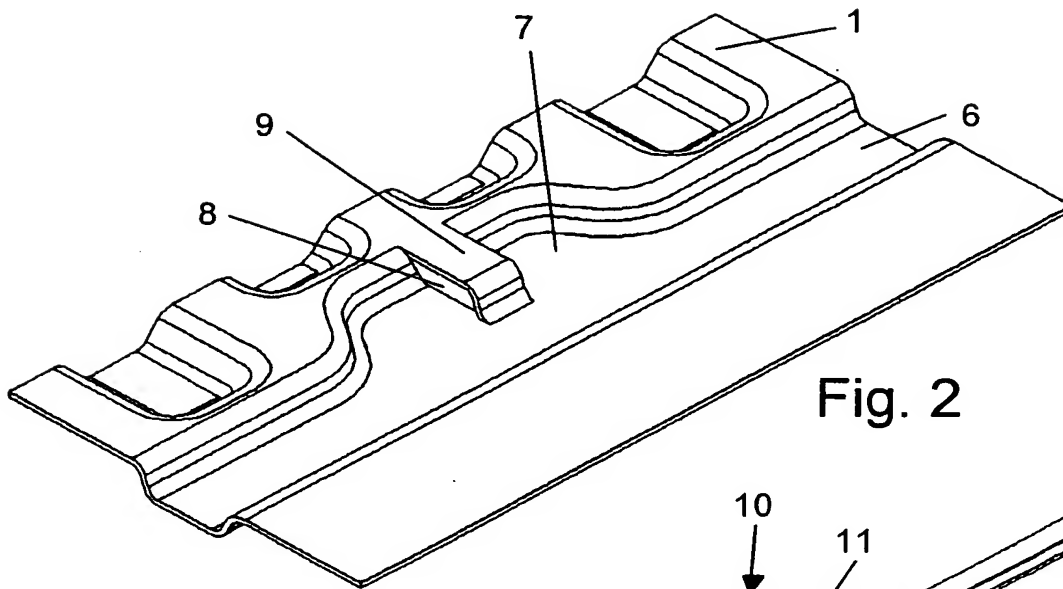


Fig. 2

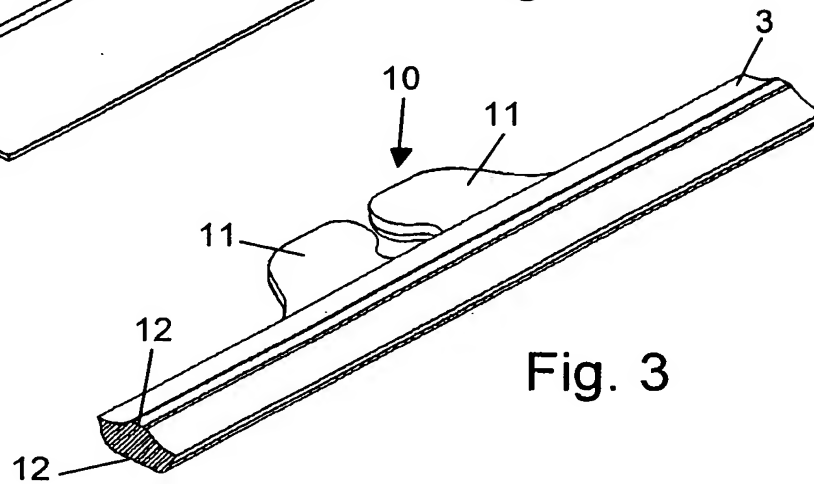


Fig. 3

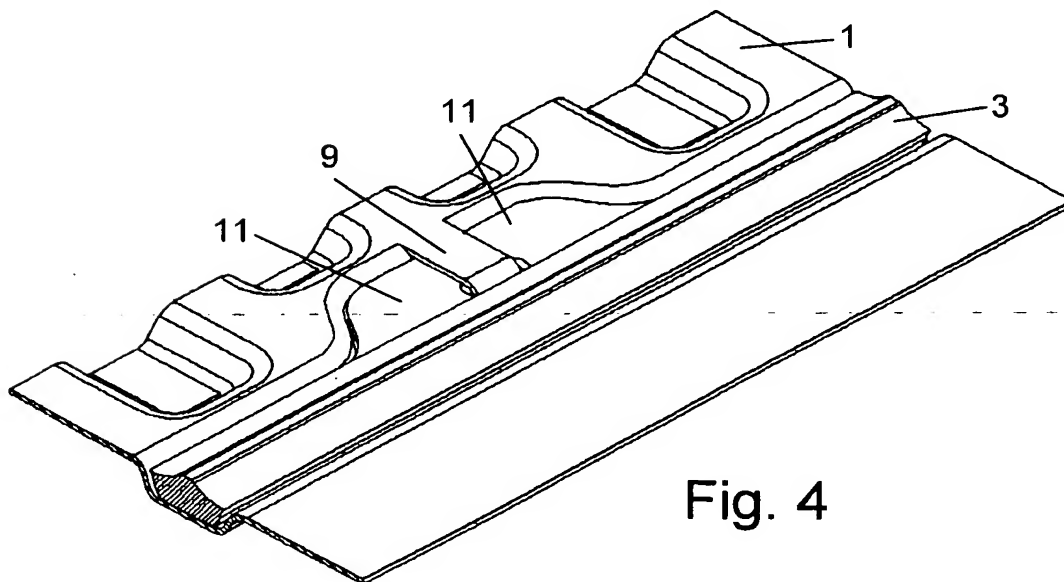


Fig. 4

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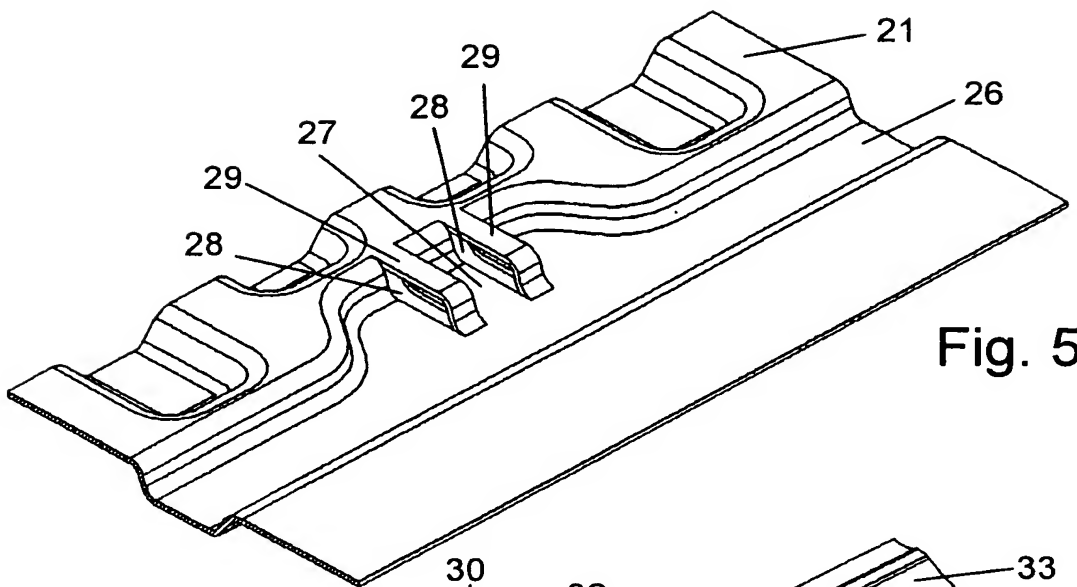


Fig. 5

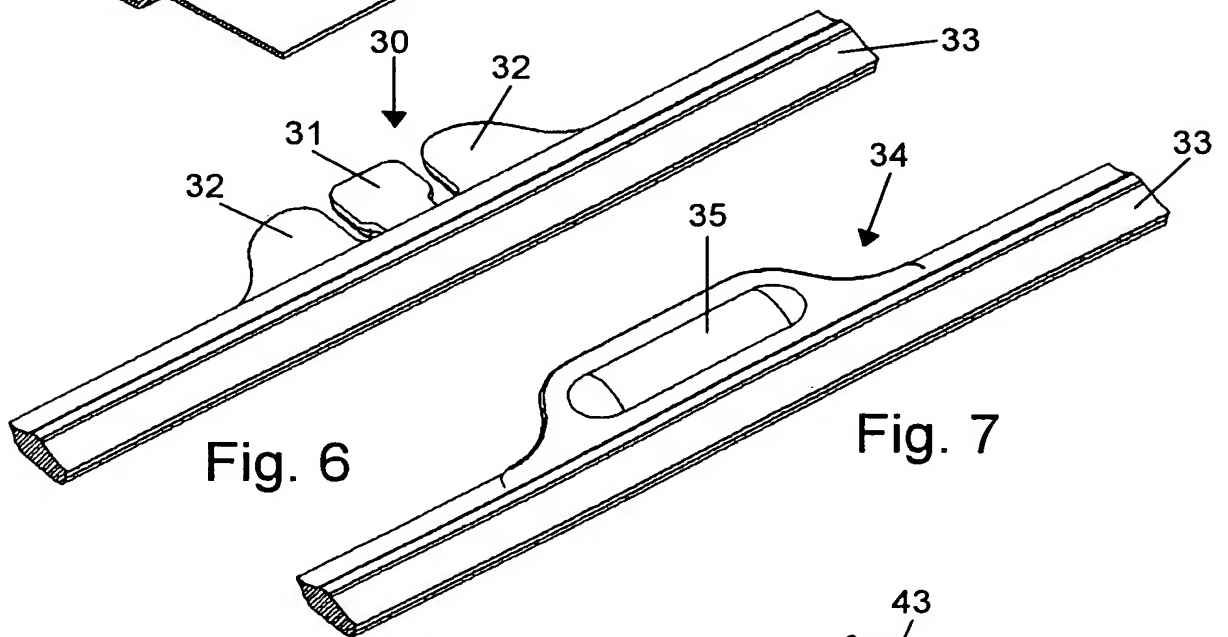


Fig. 6

Fig. 7

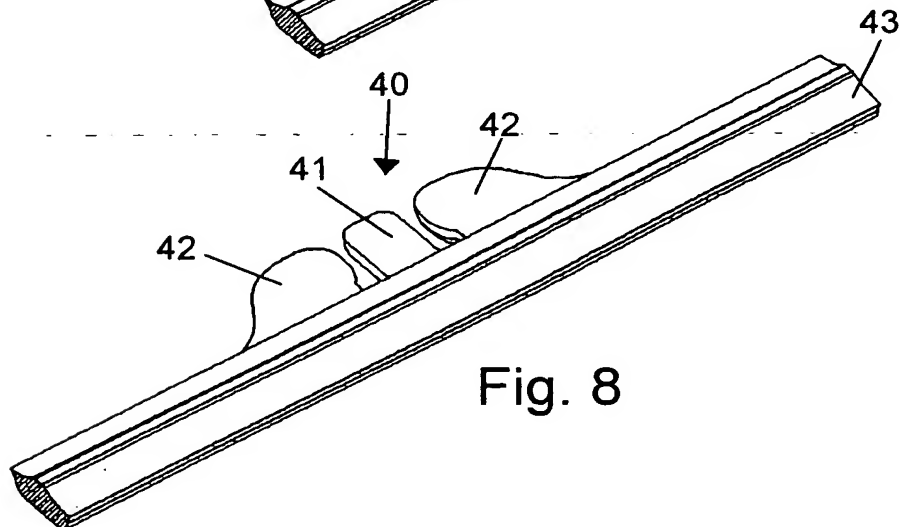


Fig. 8

**Plade til en pladevarmeveksler samt en sådan plade med en pakning**

Opfindelsen angår en plade til en pladevarmeveksler ifølge indledningen til krav 1 og en sådan plade med en tilhørende pakning ifølge indledningen til krav 4.

Pladevarmevekslere er opbygget af et antal plader adskilt af pakninger. Hver plade har generelt en rektangulær udformning og er i hvert hjørne forsynet med indløbs- og udløbsåbninger for to varmevekslermedier. Pladen er presset op i et korrugeret mønster og er forsynet med en pakning, der, når pladevarmeveksleren er samlet, ligger an mod den næste plade i stakken. Pakningen definerer et strømningsområde, der er i kontakt med to af hjørneåbningerne, og derfor tillader strømning af et første varmevekslermedium på denne side af pladen. De to andre hjørneåbninger er afspærret af pakningen. Den efterfølgende varmevekslerplade i stakken er vendt 180°, og dens pakning definerer derfor et strømningsområde, der er i kontakt med de to andre hjørneåbninger på den modsatte side af den første plade og tillader strømning af et andet varmevekslermedium på denne side af pladen. Ved at vende hver anden varmevekslerplade 180° opbygges en pladevarmeveksler, hvor hvert andet mellemrum gennemstrømmes af det første varmevekslermedium, mens de øvrige mellemrum gennemstrømmes af det andet varmevekslermedium.

Hver varmevekslerplade er generelt forsynet med et pakningsspor, hvori en pakning, der fortrinsvis er lavet af gummi, kan ilægges. For at lette samlingen af pladevarmeveksleren fastholdes pakningen i pakningssporet, og dette kan ske på forskellige måder. Traditionelt er pakningen limet fast i pakningssporet, men da dette giver problemer ved en senere adskillelse af pladevarmeveksleren, er der udviklet nye mekaniske fastholdelsesmetoder.

Disse mekaniske fastholdelsesmetoder kan deles i to grupper. I den første gruppe sker fastholdelsen ved, at pakningen er forsynet med en udragende del, der kan gå i indgreb med en åbning, der er tilvejebragt i tilknytning  
5 til pakningssporet. Åbningen kan være et udstanset hul (som vist i f.eks. US-A-4 377 204) eller den kan være dannet ved klipning og oppresning af plademateriale, hvorved der dannes en åbning, uden der fjernes materiale (som vist i f.eks. US-A-4 905 758). I den anden gruppe er  
10 pakningen og pakningssporet udformet således, at pakningen strækker sig ud over varmevekslerpladens kant og der fastholdes ved hjælp af flige, der griber om kanten (som vist i f.eks. EP-A1-0 762 071).

Den foreliggende opfindelsen relaterer sig til den gruppe  
15 af fastholdelsesmetoder, hvor der er tilvejebragt åbninger ved klipning og oppresning af plademateriale som vist i US-A-4 905 758. Denne metode har en række fordele i forhold til de andre ovennævnte metoder.

Metode, hvor der udstanses et hul i varmevekslerpladen  
20 nær pakningssporet, har den ulempe, at udstansningen af hullet - eller i realiteten mange huller med mellemrum langs pakningssporet - enten kræver en separat arbejdsproces efter pladen er presset op eller kræver, at presseværktøjet også forsynes med stanseværktøj, hvilket for-  
25 dyrer dette værktøj væsentligt. Den sidstnævnte løsning er endvidere uønsket, idet der vil være risiko for, at udstansede dele forbliver i presseværktøjet og derved kan være ødelæggende for den efterfølgende presse-/stanseproces.

30 Klipning og oppresning af materiale til dannelse af åbningen kan foregå i samme arbejdsgang som selve oppresningen af pladen, og der kræves således ikke en separat arbejdsgang, ligesom der ikke stilles de store tolerance-

krav til klippeværktøjet, og dette kan derfor forholdsvis billigt bygges ind i presseværktøjet.

I de fremgangsmåder, hvor pakningen og pakningssporet er udformet således, at pakningen strækker sig ud over varmevekslerpladens kant og der fastholdes ved hjælp af fli-  
5 ge, der griber om kanten, kræves en kompliceret udformning af pakningen, hvilket dels fordyrer prisen for fremstilling af pakningen og dels bevirker, at monteringen af pakningen er besværlig og tidskrævende.

10 En pakning til montering i åbninger, der er dannet ved klipning og oppresning af materiale, kan have en simpel udformning og er forholdsvis let at montere i pakningssporet.

US-A-4 905 758 viser en varmevekslerplade med et pakningsspor, der med mellemrum er forsynet med en udvidet del, som ligger i samme plan som selve pakningssporet, og som derfor er presset ned i forhold til det omgivende plademateriale. Ved nedpresningen er enderne af den udvidede del klippet op, således at der her er dannet åbninger i et plan, der i det væsentlige ligger vinkelret på  
20 pakningssporets længderetning.

Pakningen er forsynet med udragende koblingsdele, der passer ned i pakningssporets udvidede dele, idet de er udformet således, at de kan gå i indgreb med åbningerne,  
- - - - - 25 - der er tilvejebragt i hver ende af de udvidede dele. - - - - -

Fastholdelse af pakningen sker ved at enderne af pakningens udvidede koblingsdel presses ind i åbningerne, hvilket betyder, at fastholdelseskraften bestemmes af indgrebet mellem pakningens udvidede del og primært den øvre  
30 kant af åbningerne.



Det har vist sig, at det ved fremstilling af varmevekslerplader med en udformning, der svarer til den, der er vist i US-A-4 905 758, er vanskeligt at overholde de nødvendige tolerancer på afstanden mellem de to øvre kanter af åbningerne, idet pladematerialet trækker sig, når den i starten plane plade presses op til den ønskede profile-rede form. Hvor meget pladematerialet trækker sig afhænger dels af oppresningen af det omgivende materiale, dels af pladematerialet og dels af pladetykkelsen. Afstanden mellem de to øvre kanter kan således variere fra plade til plade og fra koblingssted til koblingssted rundt langs med pakningssporet, hvilket medfører en uønsket variation i fastholdelseskraften mellem pakningssporets udvidede del og pakningens koblingsdel. En sådan uensartet fastholdelseskraft kan give problemer under samling af en pladevarmeveksler, idet en pakning utilsigtet kan forskyde sig ud af pakningssporet, hvis den ikke er tilstrækkeligt fastholdt.

Formålet med den foreliggende opfindelse er, at anvise en varmevekslerplade af den ovenfor nævnte type, hvori afstanden mellem de kanter, som pakningen er i indgreb med, kan fremstilles indenfor snævre tolerancer, således at ovennævnte ulemper overvindes.

Dette opnås ved at indrette den indledningsvis nævnte plade som angivet i krav 1's kendetegnende del samt som angivet i krav 4's kendetegnende del med hensyn til kombinationen af en plade og en pakning.

Herved opnås en varmevekslerplade, hvor der i den udvidede del er tilvejebragt fastholdelsesåbninger på hver side af den eller de oppressede, tungeformede dele, og afstanden mellem de dannede åbninger kan holdes inden for snævre tolerancer, idet denne eller disse oppressede, tungeformede dele ikke påvirkes af, hvorledes det omkringlig-

gende materiale i øvrigt trækker sig ved fremstilling af pladen. Ved at indrette varmevekslerpladen på denne måde er det derfor muligt i alle de med mellemrum anbragte udvidede dele at tilvejebringe fastholdelsesåbninger, hvis indbyrdes afstand er holdt inden for de samme snævre tolerancer, uafhængigt af oppresningen i øvrigt og af pladematerialet og -tykkelsen. Dette medfører i øvrigt, at det samme presseværktøj kan anvendes ved fremstilling af varmevekslerplader af forskellige materialer og med forskellige tykkelser. Da pakningens koblingsdele, som er indrettet til at kunne gå i indgreb med disse åbninger, også kan fremstilles inden for snævre tolerancer, er det muligt at opnå en ensartet fastholdelseskraft overalt mellem pladen og pakningen.

I en første udførelsesform er der tilvejebragt én oppresset, tungeformet del centralt i den udvidede del, og pakningens koblingsdel omfatter to udragende flige, der er indrettet til at gå i indgreb med åbningerne tilvejebragt ved hver side af den tungeformede del. Denne udførelsesform udgør den simpleste udførelse af en varmevekslerplade ifølge opfindelsen.

I en anden udførelsesform er der tilvejebragt to oppressede, tungeformede dele i afstand fra hinanden i den udvidede del. I denne udførelsesform er der tilvejebragt fire fastholdelsesåbninger, nemlig en på hver side af de to tungeformede dele. Pakningens koblingsdel kan derfor udformes på forskellige måder, idet den kan være indrettet med udragende flige, der går i indgreb med forskellige åbninger. Pakningens koblingsdel kan således omfatte en udragende flig, der er indrettet til at gå i indgreb med de to midterste og mod hinanden vendende åbninger tilvejebragt ved hver sin tungeformet del, eller den kan omfatte to udragende flige, der er indrettet til at gå i indgreb med de to længst fra hinanden værende åbninger

tilvejebragt ved hver sin tungeformet del. Pakningen kan således være indrettet med en indgrebsflig, der klemmes inde mellem de tungeformede dele, eller med indgrebsflige, der klemmer omkring de to tungeformede dele.

- 5 Fligene på pakningens koblingsdele kan være indrettet således, at de strækker sig delvist ind i åbningerne, eller de kan være indrettet således, at de presser på åbningerne uden i væsentlig grad at strække ind i disse, alt afhængig af, hvor stor fastholdelseskraft, der ønskes.
- 10 Endelig kan pakningens koblingsdel være forsynet med en trykdel placeret over selve koblingsdelen, hvilken trykdel ikke forstyrrer funktionaliteten af pakningens koblingsdel, men som letter monteringen af pakningen på pladen.
- 15 Opfindelsen skal nu forklares nærmere med henvisning til tegningen, hvor
- fig. 1 viser en varmevekslerplade ifølge opfindelsen forsynet med en pakning,
- fig. 2 viser i forstørrelse et udsnit af udformningen af
- 20 en varmevekslerplade ifølge en første udførelsesform for opfindelsen,
- fig. 3 viser en del af en pakning, der kan monteres i varmevekslerpladen vist i fig. 2,
- fig. 4 viser pakningen vist i fig. 3 monteret i varmevekslerpladen vist i fig. 2,
- 25 fig. 5 viser i forstørrelse et udsnit af udformningen af en varmevekslerplade ifølge en alternativ udførelsesform for opfindelsen, og

fig. 6-8 viser dele af forskellige pakninger, der kan monteres i varmevekslerpladen vist i fig. 5.

Fig. 1 viser en rektangulær varmevekslerplade 1 med hjørneåbninger 2 til varmevekslermedierne. Pladen 1 er forsynet med en pakning 3, der definerer et strømningsområde 4 for det ene varmevekslermedium, idet det står i forbindelse med to af hjørneåbningerne 2. De øvrige to hjørneåbninger 2 er afspærret af pakningen 3. Fortrinsvis er pladen 1 udformet med en korrugeret overflade som vist, idet dette dels forøger varmevekslingen over pladen 1 og dels giver pladen 1 stivhed. Korrugeringerne er frembragt ved oppresning i et presseværktøj. Når en varmeveksler samles, vendes hver anden af pladerne 1 med pakning 3 180°, således at det ene varmevekslermedium strømmer mellem hver anden af pladerne, mens det andet strømmer mellem de øvrige plader. Dette er en hel traditionel opbygning af en varmeveksler.

For at lette monteringen af pladevarmeveksleren er pakningen 3 fastholdt til pladen 1. Pakningen 3 er til dette formål forsynet med udvidelser 5 jævnt fordelt rundt langs pakningen. Pladen 1 er indrettet med indhak, der er komplementære med pakningen 3's udvidelser, således at pakningen 3 kan fastholdes ved hjælp af disse indhak i pladen 1.

I fig. 2 er vist i forstørret målestok en del af en varmevekslerplade 1 ifølge en første udførelsesform for opfindelsen.

Som det fremgår, er pladen 1 forsynet med et pakningsspor 6 til optagelse af en pakning 3. Pakningssporet 6 har med mellemrum en udvidet del 7, der er komplementært med en tilsvarende udvidelse på pakningen 3. I midten af den udvidede del 7 ses en åbning 8, der er frembragt ved oppresningen af pladen 1. I denne presseoperation formes

pladen 1's korrugerede overflade og pakningssporet 6 med den udvidede del 7. Samtidig dannes åbningen 8, idet presseværktøjets to dele presser en tungeformet del 9 op i forhold til pakningssporet 6 og den udvidede del 7. Ved operationen bliver der klippet to revner i pladen 1, men der fjernes ikke materiale.

Åbningen 8 danner sammen med en tilsvarende åbning ved den modsatte side af tungen 9 pladen 1's koblingsorgan til en pakning, idet åbningen 8's øvre kant efter sammenkobling tilbageholder en indgribende del på en paknings udvidede del, som det beskrives nedenfor. Tungen 9's bredde er veldefineret, og det plademateriale, den udgøres af, udsættes i det væsentlige ikke for yderligere spændinger eller trækninger ved oppresningen, hvilket betyder, at afstanden mellem de øvre kanter af de to indgribende åbninger 8 er nøje fastlagt inden for snævre tolerancer.

Fig. 3 viser en del af en pakning 3, der passer til pakningssporet 6 i pladen 1 vist i fig. 2. Pakningen 3 er med mellemrum forsynet med koblingsdele 10, der i den viste udførelsesform består af to udragende flige 11. Udformningen af pakningen 3 og de udragende flige 11 svarer ganske nøje til udformningen af pakningssporet 6 og den udvidede del 7 heraf. Fligene 11 er udformet således, at deres mod hinanden vendende dele kan snappe ind i åbningerne 8 i pladen 1.

Pakningen er fortrinsvis fremstillet af gummi, men kan også være fremstillet af et andet materiale. Pakningen 3 kan på over- og undersiden være forsynet med pakningslæber 12 som vist for at opnå bedre pakning mellem varmevekslerpladerne, når disse samles til dannelse af en pladevarmeveksler.

Fig. 4 viser pakningen vist i fig. 3 monteret i varmevekslerpladen vist i fig. 2. Som det fremgår af de stiplede linier, strækker en del af fligene 11 på pakningen 3 sig ind i åbningerne 8 på pladen 1. Fortrinsvis snapper 5 fligene 11 ind i åbningerne 8, men fastholdelsen kan også foregå ved en ren klemvirkning, hvor pakningen 3's bløde materiale således blot klemmer omkring åbningerne 8. Som tidligere nævnt kan åbningerne 8 være forsynet med grater som følge af klipningen og oppresningen. Disse grater kan 10 efter monteringen af pakningen 3 gribe ind i gummimaterialet og dermed være med til at fastholde pakningen 3 yderligere.

Fig. 5 viser en alternativ udførelsesform for en varmevekslerplade 21 ifølge opfindelsen.

15 Pladen 21 er igen forsynet med et pakningsspor 26 med en udvidet del 27. I denne udførelsesform er den udvidede del 7 tilvejebragt ved oppresning af materiale fra pakningssporet 6 på en sådan måde, at der dannes to identiske tungeformede dele 29, der hver i det væsentlige svarer til tungen 9 i udførelsesformen vist i fig. 2. Da de 20 øvre kanter på begge tunger 29 er frie, påvirkes de ikke af pladen 21's øvrige pladedele og deres eventuelle trækninger ved fremstillingen af pladen 21, hvilket medfører, at de indbyrdes afstande mellem de dannede åbninger 28 - 25 hvoraf der i alt er fire, to for hver tunge 29 - er nøje fastlagt inden for snævre tolerancer.

Ved at danne to tunger 29 i stedet for kun én er der flere muligheder med hensyn til udformningen den tilhørende pakning, hvoraf tre er vist i fig. 6-8.

30 I fig. 6 er vist en pakning 33, der er forsynet med en koblingsdel 30 i form af en centralt udragende koblingsflig 31 og to udvendige flige 32. Den centrale koblingsflig 31 har en bredde, der generelt er lidt større end

- afstanden mellem de to oppressede tunger 29 i pladen 21's udvidede del 27, således at den kan klemmes fast mellem de to tunger 29's åbninger 28. De udvendige flige 32 er udformet komplementært med de yderste områder af pladen
- 5 21's udvidede del 27, således at pakningen 33 udfylder hele den udvidede del 27, når den er monteret. De udvendige flige 32 bidrager i denne udførelsesform ikke som sådan til fastholdelse af pakningen 33 i pakningssporet 26 og kunne for så vidt udelades.
- 10 Monteringen af pakningen 33 sker ved at lægge den ned i pakningssporet 26 og presse den centrale koblingsflig 31 ned mellem de to tunger 29, således at den snapper ind i tungerne 29's åbninger 28 og her fastholdes under tungerne 29's øvre kanter.
- 15 For at lette monteringen kan pakningen 33 som vist i fig. 7 være forsynet med en trykdel 34, der er placeret over pakningen 33's koblingsdel 30, der er vist med stiplede streger. Trykdelen 34 er sammenhængende med den centrale koblingsflig 31 og de udvendige flige 32 uden funktiona-
- 20 liteten af den centrale flig 31 dog påvirkes. Trykdelen 34 er på oversiden forsynet med en trykpude 35 i form af en opadhvælvet fortykkelse. Når pakningen 33 vist i fig. 7 monteres i pladen 21, trykkes pakningen 33's koblingsdel 30 ned i pladen 21's udvidede del 27 ved at trykke
- 25 nedad på trykpuden 35. At udforme koblingsdelen 30 med en ovenover liggende trykdel 34 er særligt interessant, hvis pakningen 33 skal monteres maskinelt i pakningssporet 26, men giver også nogle produktionsmæssige fordele i forbindelse med fremstillingen af pakningen 33.
- 30 Fig. 8 viser endnu en alternativ udførelsesform for en pakning 43, der kan monteres i pladen 21 vist i fig. 5.
- Denne pakning 43's koblingsdel 40 består ligesom koblingsdelen 30 på pakningen 33 vist i fig. 6 og 7 af en

central flig 41 og to udvendige flige 42. I denne udførelsesform er det de udvendige flige 42, der ved monteringen på varmevekslerpladen 21 går i indgreb med åbningerne 28 dannet ved de udvendige sider af de oppressede tunger 29, idet hver af disse udvendige flige 42 er forsynet med en indadragende del. Udformningen af pakningen 43's koblingsdel 40 svarer således principielt til udformningen af pakningen 3's koblingsdel 10 (fig. 2), idet der blot er større afstand mellem de udvendige flige 42 end mellem de udragende flige 11.

Den centrale flig 41 kan være udformet således, at den passer stramt ned mellem de oppressede tunger 29, hvorved den bidrager til at fastholde pakningen 43, når den er monteret på pladen 21. Den kan dog også have en bredde, der er mindre end afstanden mellem de oppressede tunger 29, hvorved den ikke bidrager til at fastholde pakningen 43, eller den eventuelt helt udelades.

Opfindelsen er blevet beskrevet med henvisning til foretrukne udførelsesformer vist på tegningen, men andre udførelsesformer, der ligger inden for opfindelsens rammer, er imidlertid tænkelige. F.eks. kan pakningerne 3's (fig. 3) og 43's (fig. 8) koblingsdele 10 hhv. 40 forsynes med en overliggende trykdel svarende til trykdelen 34 vist i fig. 7 for at lette monteringen på varmevekslerpladen 1 hhv. 21.

Pakningernes koblingsdele 10, 30 og 40 er i de viste udførelsesformer vist som udragende fra pakningerne 3, 33 og 43 med afrundede, bløde former, der giver pakningen nogle styrkemæssige og produktionsmæssige fordele. Der er dog intet til hinder for, at koblingsdelene kunne udformes på en anden måde.



## P a t e n t k r a v

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1. Varmevekslerplade (1; 21) til en pladevarmeveksler, hvilken plade (1; 21) omfatter et pakningsspor (6; 26) i  
5 form af en fordybning, som i det mindste over den del af pladen (1; 21) forløber nær pladens yderkant, og som med mellemrum er forsynet med en udvidet del (7; 27) til optagelse af en koblingsdel (10; 30; 40) på en tilhørende pakning (3; 33; 43), idet der i forbindelse med hver af  
10 de udvidede dele (7; 27) af pakningssporet (6; 26) ved klipning og oppresning af plademateriale er tilvejebragt i det mindste to åbninger (8; 28) i det væsentlige vinkelret på pakningssporets længderetning, hvilke åbninger (8; 28) er indrettet til at gå i indgreb med den nævnte  
15 koblingsdel (10; 30; 40), k e n d e t e g n e t v e d , at der i den udvidede del (7; 27) og i det væsentlige vinkelret på pakningssporet (6; 26) er tilvejebragt mindst én oppresset, tungeformet del (9; 29), idet åbningerne (8; 28) findes ved hver side af den tungeformede del (9; 29) mellem denne og den udvidede del (7; 27) af pakningssporet (6; 26).

2. Varmevekslerplade ifølge krav 1, k e n d e t e g n e t v e d , at der er tilvejebragt én oppresset, tungeformet del (9) centralt i den udvidede del (7).

25 3. Varmevekslerplade ifølge krav 1, k e n d e t e g n e t v e d , at der er tilvejebragt to oppressede, tungeformede dele (29) i afstand fra hinanden i den udvidede del (27).

4. Varmevekslerplade (1; 21) med en pakning (3; 33; 43) til en pladevarmeveksler, hvilken plade (1; 21) omfatter  
30 et pakningsspor (6; 26) i form af en fordybning, som i det mindste over den del af pladen (1; 21) forløber nær pladens yderkant, og som med mellemrum er forsynet med en

udvidet del (7; 27) til optagelse af en koblingsdel (10; 30; 40) på pakningen (3; 33; 43), idet der i forbindelse med hver af de udvidede dele (7; 27) af pakningssporet (6; 26) ved klipning og oppresning af plademateriale er  
5 tilvejebragt i det mindste to åbninger (8; 28) i det væsentlige vinkelret på pakningssporets længderetning, og idet pakningens koblingsdel (10; 30; 40) omfatter udragende flige (11; 31; 42), der kan gå i indgreb med åbningerne (8; 28), kendetegnet ved, at der i den  
10 udvidede del (7; 27) og i det væsentlige vinkelret på pakningssporet (6; 26) er tilvejebragt mindst én oppresset, tungeformet del (9; 29), idet åbningerne (8; 28) findes ved hver side af den tungeformede del (9; 29) mellem denne og den udvidede del (7; 27) af pakningssporet  
15 (6; 26), og at pakningens koblingsdel (10; 30; 40) er indrettet til at kunne gå i indgreb med disse åbninger (8; 28).

5. Varmevekslerplade med pakning ifølge krav 4, kendetegnet ved, at der er tilvejebragt én oppresset, tungeformet del (9) centralt i den udvidede del (7),  
20 og at pakningens koblingsdel (10) omfatter to udragende flige (11), der er indrettet til at gå i indgreb med åbningerne (8) tilvejebragt ved hver side af den tungeformede del (9).

25 6. Varmevekslerplade med pakning ifølge krav 4, kendetegnet ved, at der er tilvejebragt to oppresede, tungeformede dele (29) i afstand fra hinanden i den udvidede del (27), og at pakningens koblingsdel (30) omfatter en udragende flig (31), der er indrettet til at gå  
30 i indgreb med de to midterste og mod hinanden vendende åbninger (28) tilvejebragt ved hver sin tungeformet del (29).

7. Varmevekslerplade med pakning ifølge krav 4, kendetegnet ved, at der er tilvejebragt to oppressede, tungeformede dele (29) i afstand fra hinanden i den udvidede del (27), og at pakningens koblingsdel (40) omfatter to udragende flige (42), der er indrettet til at  
5 gå i indgreb med de to længst fra hinanden værende åbninger (28) tilvejebragt ved hver sin tungeformet del (29).

8. Varmevekslerplade med pakning ifølge ethvert af kravene 4-7, kendetegnet ved, at fligene (11; 31;  
10 42) på pakningens koblingsdele (10; 30; 40) strækker sig delvist ind i åbningerne (8; 28).

9. Varmevekslerplade med pakning ifølge ethvert af kravene 4-7, kendetegnet ved, at fligene (11; 31;  
42) på pakningens koblingsdele (10; 30; 40) presser på  
15 åbningerne (8; 28) uden i væsentlig grad at strække ind i disse.

10. Varmevekslerplade med pakning ifølge ethvert af kravene 4-9, kendetegnet ved, at pakningens koblingsdel (10; 30; 40) er forsynet med en oven over liggende trykdel (34).  
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## S a m m e n d r a g

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Varmevekslerplade (1) til en pladevarmeveksler, hvilken  
plade (1) omfatter et pakningsspor (6) i form af en for-  
5 dybning, som i det mindste over den del af pladen (1)  
forløber nær pladens yderkant, og som med mellemrum er  
forsynet med en udvidet del (7) til optagelse af en kob-  
lingsdel (10) på en tilhørende pakning (3). I forbindelse  
med hver af de udvidede dele (7) af pakningssporet (6) er  
10 der ved klipning og oppresning af plademateriale tilveje-  
bragt i det mindste to åbninger (8) i det væsentlige vin-  
kelret på pakningssporets længderetning, hvilke åbninger  
(8) er indrettet til at gå i indgreb med den nævnte kob-  
lingsdel (10). I den udvidede del (7) er der i det væ-  
15 sentlige vinkelret på pakningssporet (6) tilvejebragt  
mindst én oppresset, tungeformet del (9), idet åbningerne  
(8) findes ved hver side af den tungeformede del (9) mel-  
lem denne og den udvidede del (7) af pakningssporet (6).

20 Fig. 2 + 3